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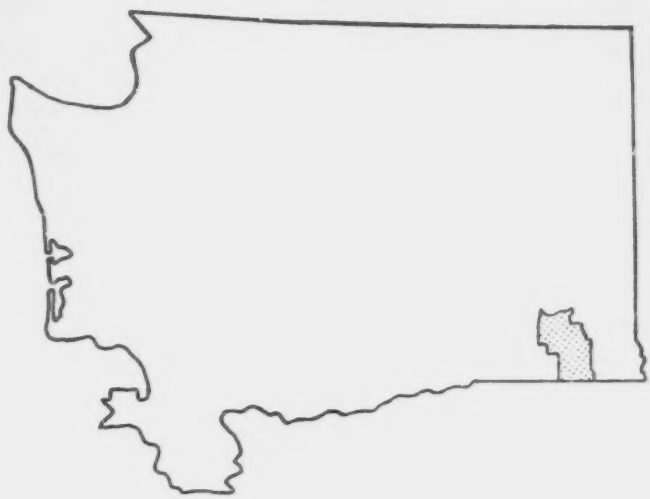
FLOOD INSURANCE STUDY

COLUMBIA COUNTY, WASHINGTON AND INCORPORATED AREAS

COMMUNITY NAME	COMMUNITY NUMBER
DAYTON, CITY OF	530030
STARBUCK, CITY OF	530031
UNINCORPORATED AREAS	530029



MAY 4, 1988

Federal Emergency Management Agency

NOTICE TO
FLOOD INSURANCE STUDY USERS

Communities participating in the National Flood Insurance Program have established repositories of flood hazard data for floodplain management and flood insurance purposes. This Flood Insurance Study may not contain all data available within the repository. It is advisable to contact the community repository for any additional data.

TABLE OF CONTENTS

		Page
1.0	INTRODUCTION	1
	1.1 Purpose of Study	1
	1.2 Authority and Acknowledgments	1
	1.3 Coordination	1
2.0	AREA STUDIED	2
	2.1 Scope of Study	2
	2.2 Community Description	2
	2.3 Principal Flood Problems	4
	2.4 Flood Protection Measures	6
3.0	ENGINEERING METHODS	6
	3.1 Hydrologic Analyses	7
	3.2 Hydraulic Analyses	9
4.0	FLOODPLAIN MANAGEMENT APPLICATIONS	10
	4.1 Floodplain Boundaries	10
	4.2 Floodways	11
5.0	INSURANCE APPLICATION	18
6.0	FLOOD INSURANCE RATE MAP	18
7.0	OTHER STUDIES	19
8.0	LOCATION OF DATA	19
9.0	BIBLIOGRAPHY AND REFERENCES	21

TABLE OF CONTENTS (cont'd)

Page

FIGURES

Figure 1 - Vicinity Map 3
Figure 2 - Floodway Schematic 17

TABLES

Table 1 - Summary of Discharges 8
Table 2 - Floodway Data 12
Table 3 - Community Map History 20

EXHIBITS

Exhibit 1 - Flood Profiles

Tucannon River	Panels 01P to 03P
Touchet River	Panels 04P to 12P
North Fork Touchet River	Panels 13P to 16P
South Fork Touchet River	Panels 17P to 20P
Patit Creek	Panels 21P to 22P
Patit Creek (Left Overbank)	Panels 23P to 24P
Johnson Hollow	Panels 25P to 29P

Exhibit 2 - Flood Insurance Rate Map Index
Flood Insurance Rate Map

Exhibit 3 - Elevation Reference Marks

FLOOD INSURANCE STUDY
COLUMBIA COUNTY, WASHINGTON AND INCORPORATED AREAS

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the geographic area of Columbia County, Washington, including the incorporated Cities of Dayton and Starbuck, and the unincorporated areas of Columbia County (hereinafter referred to collectively as Columbia County) and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study has developed flood risk data for various areas of the community that will be used to establish actuarial flood insurance rates and to assist the community in its efforts to promote sound floodplain management. Minimum floodplain management requirements for participation in the National Flood Insurance Program (NFIP) are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

In some states or communities, floodplain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence; and the State (or other jurisdictional agency) will be able to explain them.

1.2 Authority and Acknowledgments

The sources of authority for this Flood Insurance Study are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study were performed by the U.S. Army Corps of Engineers, Walla Walla District, Walla Walla, Washington, for the Federal Emergency Management Agency (FEMA), under Inter-Agency Agreement No. IAA-EMW-84-E-1506, Project Order No. 1, Amendment No. 21. This study was completed in June 1986.

1.3 Coordination

Streams requiring detailed study were identified at a meeting attended by representatives of Columbia County, the City of Dayton, the City of Starbuck, FEMA, and the study contractor in February 1984.

On April 21 and 22, 1987, the results of the study were reviewed at the final meetings attended by representatives of the study contractor, FEMA, and the communities. The study was acceptable to the communities.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the geographic area of Columbia County, Washington. The area of study is shown on the Vicinity Map (Figure 1).

The following areas were studied by detailed methods and were selected with priority given to all known flood hazard areas and areas of projected development or proposed construction through March 1991:

Tucannon River from Powers Road through Starbuck; Touchet River from County Farm Road upstream through Dayton to the North and South Forks of Touchet River; South Fork Touchet River from its confluence with the North Fork Touchet River upstream to Harting Grade Road; North Fork Touchet River from its confluence with the South Fork Touchet River upstream to the vicinity of Crall Hollow Road; Patit Creek from its confluence with the Touchet River in Dayton to the upstream corporate limits; and Johnson Hollow from the Dayton city limits upstream to Edger Road.

Approximate analyses were used to study the following areas having a low development potential or minimal flood hazards: Portions of the Tucannon River, Touchet River, South Fork Touchet River, North Fork Touchet River, Robinson Fork of North Fork of Touchet River, and Mustard Hollow at Dayton.

The scope and methods of study for these areas were proposed to and agreed upon by FEMA and the Columbia County Commissioners.

2.2 Community Description

Columbia County is located in southeastern Washington and is bordered by the state of Oregon on the south, the Snake River on the north, Walla Walla County on the west, and Garfield County on the east. The county encompasses 859.5-square miles and is ranked thirty-first in size within the state (Reference 1).

There are two incorporated cities within the county. Dayton, being the largest and also the county seat, is located in the central part of the county. The City of Starbuck is located in the northwest corner of the county.

Columbia County has only 0.1 percent of the state population (Reference 2). Census counts for areas within Columbia County are as follows:

Community	1970 Population	1980 Population
City of Dayton	2,565	2,596
City of Starbuck	216	198
Unincorporated Areas	4,439	4,057

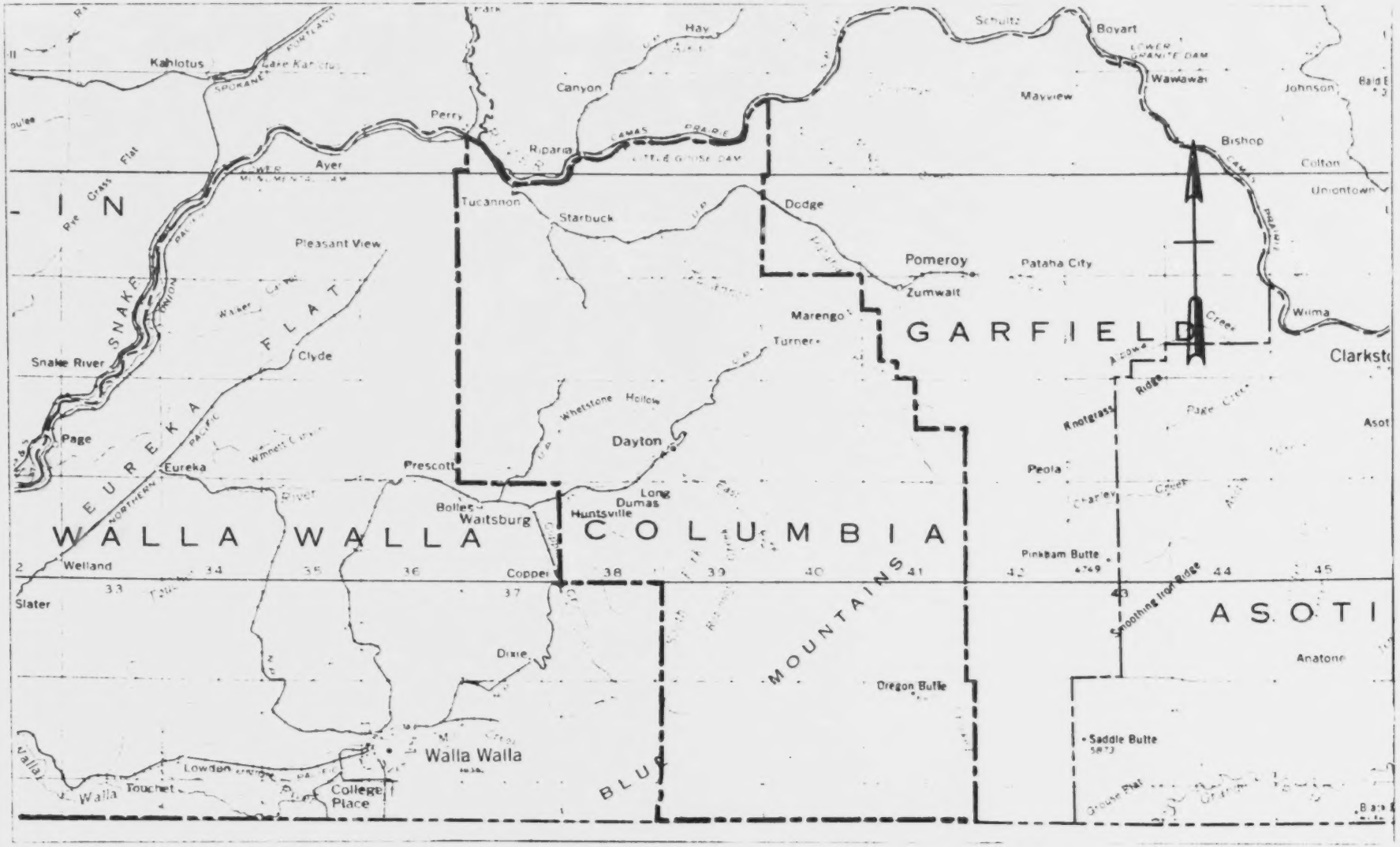


FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

COLUMBIA COUNTY, WA
AND INCORPORATED AREAS

APPROXIMATE SCALE

40 Miles

VICINITY MAP

The southeastern one-third of the county is comprised of the timbered slopes of the Blue Mountains which slope to the west and north to form the rolling plateau farmlands extending to the Snake River. Columbia County bases its economy on agriculture, with wheat and vegetable production leading its output and timber harvesting a secondary economic base.

The climate in Columbia County consists of warm summers and cold winters characteristic of a semiarid land. On occasion, during the winter months, influxes of polar air masses will cause periods of extremely cold temperatures. Temperatures at Dayton have been recorded ranging from -22°F to a maximum of 114°F, with a mean annual temperature of 50.9°F (Reference 3). The mean annual precipitation at Dayton is 17.5 inches with a maximum of 29.8 inches recorded. Mean seasonal snowfall at Dayton is 18.5 inches with a maximum seasonal snowfall of 44.5 inches recorded (Reference 4).

The Tucannon River flows northwesterly along the southern and western corporate limits of Starbuck and is a major source of flooding in that community. It originates in the forested, deep canyons of the Blue Mountains at about 6,000 feet National Geodetic Vertical Datum (NGVD) and flows northerly and westerly to the Snake River through a narrow valley among rolling farmland.

The Touchet River flows northwesterly through Dayton. Flooding occurs on the east bank of the river at the downstream corporate limits. The Touchet River also originates in the canyons of the Blue Mountains at about 6,000 feet NGVD.

Patit Creek flows southeasterly through Dayton to the Touchet River and is a major source of flooding. It originates in the western slopes of the Blue Mountains between 4,000 and 5,800 feet NGVD and drains an approximately 66-square-mile area of rolling Blue Mountain foothills.

Mustard Hollow is a small drainage east of Dayton with an area of 3.3 square miles. It originates in the lower foothills of the Blue Mountains and is an intermittent stream subject to flows from snowmelt, rainstorm, and thunderstorm runoff.

2.3 Principal Flood Problems

The Tucannon River Basin usually has high flows in the spring from snowmelt and low flows in the summer and fall. However, major floods have occurred in the winter from general rainstorms, which cause a high percentage of runoff.

Past flooding on the Tucannon River within Starbuck indicates that flooding may occur during any season of the year; however, most major floods have occurred from December through February and are usually the result of warm winds with rainstorms and snowmelt.

A number of major floods have occurred on the Tucannon River in the past. The four worst recorded floods and estimated recurrence intervals are shown below.

Date	Discharge (cubic feet per second)	Recurrence Interval (Years)
December 1964	7,980	18.0
February 1930	6,000	9.5
January 1965	4,300	5.0
January 1974	4,080	4.8

The floodwaters caused damage to buildings and bridges within the City of Starbuck.

The Touchet River Basin is very similar to the Tucannon River Basin in seasonal runoff occurrence.

Floods of significant size have occurred. Their flows and the estimated recurrence intervals of gaged flows are shown below.

Date	Flow Location (cubic feet per second)	Recurrence Interval (Years)
May 1906	6,000 estimated at Dayton	----
April 1931	6,000 estimated at Dayton	----
February 1949	9,000 estimated at Bolles Gage downstream of Waitsburg	----
December 1964	9,350 gaged at Bolles Gage	67
January 1965	5,690 gaged at Bolles Gage	10

Mustard Hollow and Patit Creek present the major flooding problems, while the Touchet River poses minimal flooding threat in the Dayton area. Two floods from Mustard Hollow have caused damages to Dayton in recent years. These occurred on February 10, 1949, and May 9, 1956. The 1956 flood was the more severe of the two and was the result of a sudden intense rainstorm in the Mustard Hollow drainage basin. Patit Creek can cause major flooding in Dayton; however, there are very few records available on past flooding from Patit Creek.

2.4 Flood Protection Measures

Flood damage prevention on streams in the unincorporated areas of the county are limited to those constructed by local interests or by Federal agencies under emergency conditions. They consist of channel clearing and emergency levee construction and are not considered permanent nor adequate to provide protection from a 100-year flood event.

The City of Dayton is, however, protected from flooding of the Touchet River by levees completed in February 1965. These levees are considered capable of providing 100-year flood protection. No flood control structures exist on Patit Creek or Mustard Hollow within the City of Dayton.

In the spring of 1964, the City of Starbuck and the State of Washington cleared the Tucannon River channel and constructed levees. The channel improvement was severely damaged in the December 1964 flood. Channel and levee restoration work was undertaken by the Corps of Engineers under Public Law 99 authority immediately following the December 1964 flood and was completed before the January 1965 flood. The existing levees will offer minor flood protection, but not 100-year flood protection for the City of Starbuck.

Nonstructural measures of flood protection are also being used to decrease future damages. These are in the form of land use regulations, adopted form the Code of Federal Regulations, which control building within areas that have a high risk of flooding (Reference 5).

3.0 ENGINEERING METHODS

For the flooding sources studied by detailed methods in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude which are expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for floodplain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10, 2, 1, and 0.2 percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long term <u>average</u> period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (1 percent chance of annual exceedence) in any 50-year period is approximately 40 percent (4 in 10), and for any 90-year period, the risk increases to approximately 60 percent (6 in 10).

The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish peak discharge-frequency relationships for each flooding source studied by detailed methods affecting the community.

The analyses were completed in two parts, with the first part covering the Touchet River and its tributaries near Dayton and the second part covering the Tucannon River near Starbuck.

In the first part, a regional analysis was performed to compute the annual peak discharge-frequency curves for the Touchet River and its tributaries. Since the Touchet River is ungaged in the study reach, three gaging stations located within the Touchet River basin - East Fork Touchet near Dayton, Touchet River at Bolles, and Touchet River near Touchet - were used to perform the frequency analysis. Initially, a regional frequency analysis was used to extend the period of record of the three gage sites to cover the period from 1906 to 1981. Then, based on the extended periods of record, the mean logarithm and standard deviation were computed for each site using methods outlined in the Water Resources Council "Guidelines for Determining Flood Flow Frequencies," Bulletin 17B (Reference 6).

Once the frequency statistics (i.e. mean logarithm and standard deviation) were computed, two curves were plotted to relate the frequency statistics to basin characteristics. The first curve related the mean logarithm to the drainage area and was derived from three points plotted to represent the three gaged sites in the basin. The second curve related the standard deviation to the drainage area times normal annual precipitation divided by one hundred and was derived in the same manner. These two curves provided a means of estimating the frequency statistics given the basin characteristics for any ungaged location in the Touchet River basin.

Basin characteristics were computed for each of the locations of interest within the study area. The two regional curves were then used to determine the frequency statistics for each location. With the resulting frequency statistics and a skew of +0.3 based on other streams in the vicinity, an annual peak discharge-frequency curve was developed for each of the following ungaged locations:

(1) Touchet River below Patit Creek at Dayton.

(2) Touchet River above Patit Creek at Dayton.

(3) North Fork Touchet River near Dayton.

(4) South Fork Touchet River near Dayton.

(5) Patit Creek at Dayton.

(6) Johnson Hollow at Dayton.

The second part of the hydrologic analysis determined the annual peak discharge-frequency curve for the Tucannon River at Starbuck. The Tucannon River is ungaged at Starbuck; however, there is a U.S. Geological Survey (USGS) stream gaging station 3 miles east of Starbuck. With a period of record of 1915-17, 1929-31, 1949, and 1959-81, this gage, USGS #13344500, is located at River Mile 7.9 and has a drainage area of 431 square miles. The annual peak discharge-frequency curve for this gage was derived using methods outlined in the Water Resources Council "Guidelines for Determining Flood Flow Frequencies," Bulletin 17B (Reference 6). The Tucannon River at Starbuck, Washington, annual peak discharge-frequency curve was derived by applying the ratio of the drainage area at Starbuck (490 square miles) and drainage area at the USGS gage to specific frequency discharges from the Tucannon River near Starbuck annual peak discharge-frequency curve.

Peak discharge-drainage area relationships for the streams studied by detailed methods are shown in Table 1.

TABLE 1. SUMMARY OF DISCHARGES

Flooding Source and Location	Drainage Area (square miles)	Peak Discharges (cubic feet per second) 10-Year	50-Year	100-Year	500-Year
Tucannon River at Starbuck	490.0	6,300	11,700	14,300	21,100
Touchet River below Patit Creek at Dayton	233.0	4,100	6,550	7,800	11,400
Touchet River above Patit Creek at Dayton	164.0	3,270	5,380	6,470	9,520
Patit Creek at Dayton	66.0	1,820	3,000	3,600	5,250
Johnson Hollow at Dayton	9.4	530	880	1,060	1,560
North Fork Touchet River near Dayton	115.0	2,570	4,200	5,030	7,360
South Fork Touchet River near Dayton	44.0	1,390	2,290	2,750	4,040

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals.

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway was computed (Section 4.2), selected cross section locations are also shown on the Flood Insurance Rate Map (Exhibit 2).

Cross sections for backwater analysis of the streams in the study area were obtained from aerial photographs and field surveys. The below-water sections were obtained by field measurement. All bridges, dams, and culverts were field checked to obtain elevation data and structural geometry.

Channel roughness factors (Manning's "n") used in the hydraulic computations were chosen by engineering judgment and were based on field observations of the streams and floodplain areas. Roughness values assigned to the streams within Columbia County are as follows:

Stream	Range of "n" Values	
	Channel	Overbank
Tucannon River	0.037	0.040-0.045
Touchet River	0.035	0.050-0.130
North Fork Touchet River	0.035-0.130	0.035-0.130
South Fork Touchet River	0.035-0.130	0.035-0.130
Johnson Hollow	0.030-0.045	0.040-0.060
Patit Creek	0.045-0.065	0.027-0.065

Water-surface elevations of floods of the selected recurrence intervals were computed through use of the Corps of Engineers HEC-2 water-surface profiles generalized computer program (Reference 7). Flood profiles were drawn showing computed water-surface elevations for floods of the selected recurrence intervals. Starting water-surface elevations for the Touchet River and the Tucannon River were computed using the slope-area method discussed in the HEC-2 user's manual (Reference 7). Starting water-surface elevations for North Fork Touchet River, South Fork Touchet River, Patit Creek, and Johnson Hollow were known water-surface elevations computed in the Touchet River and Patit Creek HEC-2 models.

Due to low elevations in the overbank areas of Patit Creek and Johnson Hollow, the hydraulic analyses included divided flow reaches along portions of both streams. On Patit Creek, the divided flow reach is in the left overbank extending from the Front Street bridge upstream to the end of the study reach. For the 10-, 50-, 100-, and 500-year flows wherever the water-surface elevations exceeded the channel banks, a portion of the discharge was removed

from the channel and introduced into the low area in the left overbank at the appropriate location. Cross section geometry forces the left overbank flow to rejoin the channel in the area of the Front Street bridge. This analysis produced lower water-surface elevations in the left overbank than those found in the channel, a condition which would be expected in a perched channel situation.

A similar condition exists on the lower end of Johnson Hollow. There, the divided flow reach is in the right overbank extending from the mouth upstream beyond the corporate limit boundary. For the 50-, 100-, and 500-year flows, a portion of the discharge was removed from the channel and directed into the low area in the right overbank.

The hydraulic analyses for this study were based on unobstructed flow. The flood elevations shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

All elevations are referenced to the NGVD of 1929. Elevation reference marks used in this study are shown on the maps; the descriptions of the marks are presented in Elevation Reference Marks (Exhibit 3).

4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

The NFIP encourages state and local governments to adopt sound floodplain management programs. Therefore, each Flood Insurance Study provides 100-year flood elevations and delineations of the 100- and 500-year floodplain boundaries and 100-year floodway to assist communities in developing floodplain management measures.

4.1 Floodplain Boundaries

To provide a national standard without regional discrimination, the 1 percent annual chance (100-year) flood has been adopted by FEMA as the base flood for floodplain management purposes. The 0.2 percent annual chance (500-year) flood is employed to indicate additional areas of flood risk in the community. For each stream studied in detail, the 100- and 500-year floodplain boundaries have been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using topographic maps at a scale of 1:2400, with a contour interval of 5 feet (Reference 8).

The 100- and 500-year floodplain boundaries are shown on the Flood Insurance Rate Map (Exhibit 2). On this map, the 100-year floodplain boundary corresponds to the boundary of the areas of special flood hazards (Zones A, AE, AH, and AO); and the 500-year floodplain boundary corresponds to the boundary of areas of moderate flood hazards. In cases where the 100- and 500-year

floodplain boundaries are close together, only the 100-year floodplain boundary has been shown. Small areas within the floodplain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

For the streams studied by approximate methods, only the 100-year floodplain boundary is shown on the Flood Insurance Rate Map (Exhibit 2). This 100-year boundary was developed using normal depth calculation and the topographic maps referenced above.

Approximate 100-year floodplain boundaries in some portions of the study area were taken directly from the Flood Hazard Boundary Map (Reference 9).

4.2 Floodways

Encroachment on floodplains, such as structures and fill, reduces flood-carrying capacity, increases flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of floodplain management involves balancing the economic gain from floodplain development against the resulting increase in flood hazard. For purposes of the NFIP, a floodway is used as a tool to assist local communities in this aspect of floodplain management. Under this concept, the area of the 100-year floodplain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent floodplain areas, that must be kept free of encroachment so that the 100-year flood can be carried without substantial increases in flood heights. Minimum Federal standards limit such increases to 1.0 foot, provided that hazardous velocities are not produced. The floodways in this study are presented to local agencies as minimum standards that can be adopted directly or that can be used as a basis for additional floodway studies.

The floodways presented in this study were computed for certain stream segments on the basis of equal conveyance reduction from each side of the floodplain. Floodway widths were computed at cross sections. Between cross sections, the floodway boundaries were interpolated. The results of the floodway computations are tabulated at selected cross sections (Table 2). In cases where the floodway and 100-year floodplain boundaries are either close together or collinear, only the floodway boundary has been shown.

Due to the extensive development in the left overbank along Patit Creek and the limited channel capacity, the determination of a floodway along the entire study reach was not possible. Above the Third Street bridge, the floodway was determined to stay within the channel area. However, below the Third Street bridge, the floodway cannot be restricted to the channel. Below this point the existing streets and alleys within the 100-year floodplain must remain unobstructed to provide a flow path for any discharge escaping from the channel area.

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION [3]			
CROSS SECTION	DISTANCE[1]	WIDTH[2] (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Tucannon River								
A	-400	305	1936	7.4	572.3	572.3	573.3	1.0
B	-125	343	1768	8.1	574.7	574.7	574.7	0.0
C	52	435	3571	4.0	578.1	578.1	578.4	0.3
D	916	529	2937	4.9	578.7	578.7	579.1	0.4
E	2,087	348	1527	9.4	585.0	585.0	585.1	0.1
F	3,198	422	2123	6.7	590.5	590.5	591.3	0.8
G	5,107	285	1375	10.4	600.9	600.9	600.9	0.0
H	6,060	417	2332	6.1	605.9	605.9	606.1	0.2
I	7,073	578	2021	7.1	610.7	610.7	610.7	0.0
J	8,100	592	2055	7.0	616.3	616.3	616.5	0.2
K	9,092	659	2110	6.8	621.7	621.7	622.0	0.3
L	9,529	419	2228	6.4	624.9	624.9	625.9	1.0
M	10,863	440	1813	7.9	631.3	631.3	631.3	0.0
N	11,806	521	1980	7.2	637.1	637.1	637.6	0.5
O	12,386	443	1657	8.6	640.5	640.5	640.8	0.3
P	12,639	407	1607	8.9	643.8	643.8	644.3	0.5
Q	12,883	343	2231	6.4	645.8	645.8	646.4	0.6
R	13,626	230	1493	9.6	649.2	649.2	649.8	0.6
S	14,135	418	2196	6.5	651.6	651.6	652.4	0.8
T	15,102	321	1963	7.3	654.4	654.4	654.8	0.4
U	15,888	240	1627	8.8	658.4	658.4	659.3	0.9

[1]Distance in feet from Powers Road Bridge measured along Tucannon River centerline. [2]Floodway widths measured along cross section alignments. [3]Maximum Water Surface Elevations (MAXWS) defined as being the greater of either (a) the computed Water Surface Elevation (CWSEL) or (b) the sum of the Critical Water Surface Elevation and 0.4 x the Mean Velocity Head (CRIWS + 0.4 x HV).

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

COLUMBIA COUNTY, WA
AND INCORPORATED AREAS

FLOODWAY DATA

TUCANNON RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH[2] (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Touchet River								
A	-1000	109	796	9.8	1509.3	1509.3	1510.3	1.0
B	-187	125	784	9.9	1514.1	1514.1	1514.1	0.0
C	1,142	250	1160	6.7	1520.8	1520.8	1520.9	0.1
D	1,997	316	888	8.8	1525.4	1525.4	1525.4	0.0
E	2,975	440	1284	6.1	1532.0	1532.0	1532.0	0.0
F	4,734	308	1217	6.4	1542.3	1542.3	1542.7	0.4
G	5,742	325	1029	7.6	1548.0	1548.0	1548.0	0.0
H	7,113	320	1035	7.5	1556.6	1556.6	1556.6	0.0
I	8,426	126	645	12.1	1567.9	1567.9	1567.9	0.0
J	9,375	134	843	9.3	1573.6	1573.6	1574.1	0.5
K	10,106	184	852	9.2	1578.3	1578.3	1578.7	0.4
L	11,114	163	814	9.6	1584.0	1584.0	1584.3	0.3
M	11,701	199	871	9.0	1588.2	1588.2	1588.2	0.0
N	12,240	169	650	10.0	1591.6	1591.6	1591.6	0.0
O	12,784	147	550	11.8	1596.4	1596.4	1596.4	0.0
P	12,996	150	648	10.0	1598.1	1598.1	1598.1	0.0
Q	13,235	151	703	9.2	1599.7	1599.7	1599.7	0.0
R	13,501	148	574	11.3	1601.7	1601.7	1601.7	0.0
S	13,773	157	536	12.1	1604.9	1604.9	1604.9	0.0
T	14,000	148	579	11.2	1607.1	1607.1	1607.1	0.0
U	14,153	148	660	9.8	1608.3	1608.3	1608.3	0.0
V	14,504	150	608	10.6	1610.5	1610.5	1610.5	0.0
W	14,783	166	679	9.5	1612.8	1612.8	1612.8	0.0
X	15,215	231	741	8.7	1616.3	1616.3	1616.3	0.0
Y	15,548	180	629	10.3	1619.4	1619.4	1619.4	0.0
Z	15,607	186	776	8.3	1620.1	1620.1	1620.1	0.0

[1]Distance in feet from the County Road 2427 Bridge.
[2]Distance along cross section alignment.

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

COLUMBIA COUNTY, WA
AND INCORPORATED AREAS

FLOODWAY DATA

TOUCHET RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH[2] (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Touchet River (cont'd)								
AA	15,947	169	554	11.7	1623.6	1623.6	1623.6	0.0
AB	16,205	192	823	7.9	1625.8	1625.8	1625.8	0.0
AC	16,348	202	612	10.6	1626.9	1626.9	1626.9	0.0
AD	16,820	147	613	10.5	1631.4	1631.4	1631.4	0.0
AE	17,008	151	714	9.1	1632.9	1632.9	1632.9	0.0
AF	17,753	155	605	10.7	1638.6	1638.6	1638.6	0.0
AG	18,949	206	719	9.0	1648.6	1648.6	1648.6	0.0
AH	19,694	223	781	8.3	1653.9	1653.9	1653.9	0.0
AI	20,312	359	890	7.3	1660.3	1660.3	1660.3	0.0
AJ	21,146	221	723	8.9	1666.7	1666.7	1666.9	0.2
AK	21,649	197	745	8.7	1670.6	1670.6	1671.0	0.4

[1]Distance in feet from the County Road 2427 Bridge.
[2]Distance along cross section alignment.

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

COLUMBIA COUNTY, WA
AND INCORPORATED AREAS

FLOODWAY DATA

TOUCHET RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH[2] (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
North Fork Touchet River								
A	522	272	663	7.6	1677.6	1677.6	1677.6	0.0
B	1,377	187	495	10.2	1686.9	1686.9	1686.9	0.0
C	2,301	190	516	9.7	1699.1	1699.1	1699.4	0.3
D	2,749	159	752	6.7	1703.6	1703.6	1703.8	0.2
E	3,442	479	853	5.9	1708.8	1708.8	1708.9	0.1
F	4,260	200	569	8.8	1718.0	1718.0	1718.0	0.0
G	5,063	309	641	7.9	1726.1	1726.1	1726.1	0.0
H	6,600	110	445	11.3	1741.8	1741.8	1741.8	0.0
I	7,396	175	575	8.8	1749.2	1749.2	1749.2	0.0
J	8,352	137	456	11.0	1761.4	1761.4	1761.4	0.0
South Fork Touchet River								
A	580	312	477	5.8	1677.5	1677.5	1677.5	0.0
B	1,439	254	493	5.6	1687.6	1687.6	1687.6	0.0
C	2,381	214	345	8.0	1698.9	1698.9	1699.9	0.1
D	3,046	143	314	8.8	1707.0	1707.0	1707.0	0.0
E	4,650	218	443	6.2	1724.4	1724.4	1724.4	0.0
F	5,892	256	360	7.6	1736.3	1736.3	1736.3	0.0
G	6,670	244	544	5.1	1743.7	1743.7	1743.7	0.0
H	8,207	95	280	9.8	1762.1	1762.1	1762.1	0.0

[1]Distance in feet above confluence of North and South Forks of Touchet River.
[2]Distance along cross section alignment.

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

COLUMBIA COUNTY, WA
AND INCORPORATED AREAS

FLOODWAY DATA

NORTH FORK TOUCHET RIVER
SOUTH FORK TOUCHET RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH[2] (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Patit Creek								
D	2,794	196	1486	2.4	1615.8	1615.8	1616.6	0.8
E	3,871	123	466	7.7	1622.6	1622.6	1622.6	0.0
F	4,217	125	661	5.5	1626.3	1626.3	1626.3	0.0
G	4,998	99	683	5.3	1632.6	1632.6	1632.6	0.0
Johnson Hollow								
	Distance[3]							
A	105	39	148	5.3	1628.5	1628.5	1628.5	0.0
B	144	33	84	9.2	1628.5	1628.5	1628.5	0.0
C	476	43	137	7.7	1634.3	1634.3	1634.7	0.4
D	1,457	50	140	7.5	1645.9	1645.9	1646.0	0.1
E	2,440	88	162	6.5	1662.2	1662.2	1662.2	0.0
F	3,409	203	214	4.9	1679.3	1679.3	1679.8	0.5
G	4,195	146	189	5.6	1690.7	1690.7	1690.8	0.1
H	5,210	100	252	4.2	1705.6	1705.6	1706.3	0.7
I	6,150	57	182	5.8	1725.2	1725.2	1725.5	0.3

[1]Distance in feet above the confluence with Touchet River.
[2]Distance along cross section alignment.
[3]Distance in feet above the confluence with Patit Creek.

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

COLUMBIA COUNTY, WA
AND INCORPORATED AREAS

FLOODWAY DATA

PATIT CREEK
JOHNSON HOLLOW

On Johnson Hollow, at the northern corporate limit of the City of Dayton, the existing channel has insufficient capacity to contain the 100-year floodflow. Because of this an overbank floodway has been established beginning below Cross Section C at the northern corporate limit. The channel right bank downstream of this point must remain unobstructed for a distance of 87 feet to allow a weir discharge into the overbank floodway. The overbank floodway can follow any path within the area bordered by Dayton Avenue and Cross Section C, providing that it leaves the channel just downstream of Cross Section C and travels to the intersection of 6th Street and Dayton Avenue, with the following minimum floodway widths maintained:

Stream Reach	Minimum Width
First 55 feet from channel	87 feet
Next 55 to 130 feet from the channel	40 feet
Remaining distance to 6th Street and Dayton Avenue intersection	36 feet
Along 6th Street to Patit Creek or Along Dayton Avenue to Touchet River	30 feet

The area between the floodway and 100-year floodplain boundaries is termed the floodway fringe. The floodway fringe encompasses the portion of the floodplain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to floodplain development are shown in Figure 2.

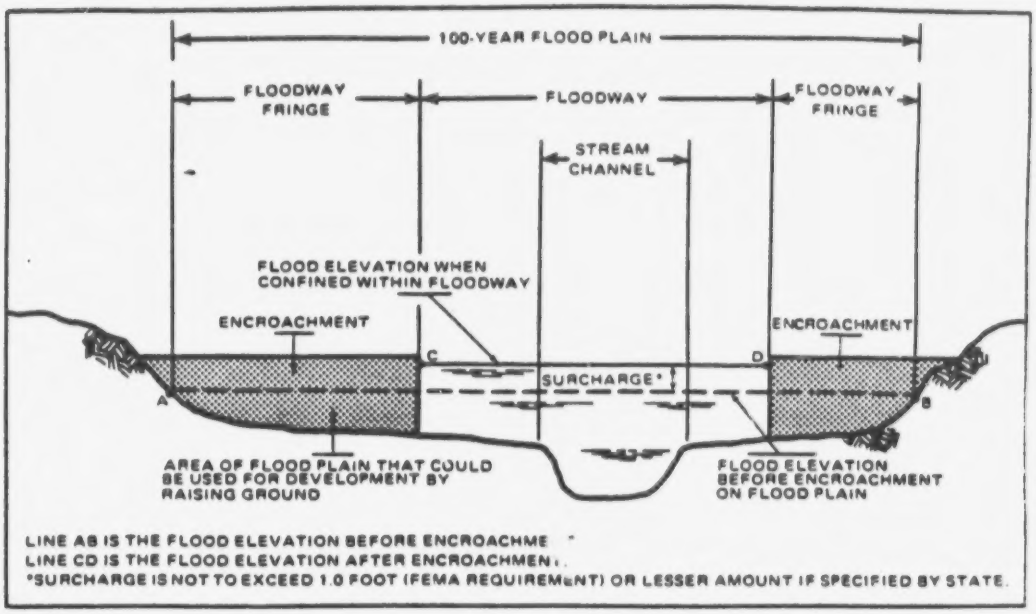

100-YEAR FLOOD PLAIN
FLOODWAY FRINGE
FLOODWAY
FLOODWAY FRINGE
STREAM CHANNEL
FLOOD ELEVATION WHEN CONFINED WITHIN FLOODWAY
ENCROACHMENT
ENCROACHMENT
C
D
SURCHARGE*
A
B
AREA OF FLOOD PLAIN THAT COULD BE USED FOR DEVELOPMENT BY RAISING GROUND
FLOOD ELEVATION BEFORE ENCROACHMENT ON FLOOD PLAIN
LINE AB IS THE FLOOD ELEVATION BEFORE ENCROACHME
LINE CD IS THE FLOOD ELEVATION AFTER ENCROACHMEN
*SURCHARGE IS NOT TO EXCEED 1.0 FOOT (FEMA REQUIREMENT) OR LESSER AMOUNT IF SPECIFIED BY STATE.

Figure 2. Floodway Schematic

5.0 INSURANCE APPLICATION

For flood insurance rating purposes, flood insurance zone designations are assigned to a community based on the results of the engineering analyses. These zones are as follows:

Zone A

Zone A is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no base flood elevations or depths are shown within this zone.

Zone AE

Zone AE is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by detailed methods. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone AO

Zone AO is the flood insurance rate zone that corresponds to the areas of 100-year shallow flooding (usually sheetflow on sloping terrain) where average depths are between 1 and 3 feet. Average whole-foot depths derived from the detailed hydraulic analyses are shown within this zone.

Zone AH

Zone AH is the flood insurance rate zone that corresponds to the areas of 100-year shallow flooding (usually areas of ponding) where average depths are between 1 and 3 feet. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone X

Zone X is the flood insurance rate zone that corresponds to areas outside the 500-year floodplain, areas within the 500-year floodplain, areas of 100-year flooding where average depths are less than 1 foot, areas of 100-year flooding where the contributing drainage area is less than 1 square mile, and areas protected from the 100-year flood by levees. No base flood elevations or depths are shown within this zone.

6.0 FLOOD INSURANCE RATE MAP

The Flood Insurance Rate Map is designed for flood insurance and floodplain management applications.

For flood insurance applications, the map designates flood insurance rate zones as described in Section 5.0 and, in the 100-year floodplains that were studied by detailed methods, shows selected whole-foot base flood elevations or average depths. Insurance agents use the zones and base flood elevations in conjunction with information on structures and their contents to assign premium rates for flood insurance policies.

For floodplain management applications, the map shows by tints, screens, and symbols the 100- and 500-year floodplains, the floodways, and the locations of selected cross sections used in the hydraulic analyses and floodway computations.

7.0 OTHER STUDIES

The current Flood Insurance Rate Map presents flooding information for the entire geographic area of Columbia County. Previously, separate Flood Hazard Boundary Maps and/or Flood Insurance Rate Maps were prepared for each identified flood-prone incorporated community and the unincorporated areas of the county. Historical data relating to the maps prepared for each community are presented in Table 3, Community Map History.

Due to its more detailed analysis, the Flood Insurance Study supersedes the previously printed Flood Hazard Boundary Maps for the unincorporated areas of Columbia County and the incorporated areas of Dayton and Starbuck (References 9, 10, and 11).

8.0 LOCATION OF DATA

Information concerning the pertinent data used in the preparation of this study can be obtained by contacting the Natural and Technological Hazards Division, FEMA, Federal Regional Center, 130 228th Street, S.W., Bothell, Washington 98021-9796.

COMMUNITY NAME	INITIAL IDENTIFICATION	FLOOD HAZARD BOUNDARY MAP REVISIONS DATE	FIRM EFFECTIVE DATE	FIRM REVISIONS DATE
Dayton, City of	April 12, 1974	January 9, 1976	May 4, 1988	
Starbuck, City of	January 3, 1975	January 3, 1975	May 4, 1988	
Unincorporated Areas	August 2, 1977	August 2, 1977	May 4, 1988	

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

COLUMBIA COUNTY, WA
AND INCORPORATED AREAS

COMMUNITY MAP HISTORY

9.0 BIBLIOGRAPHY AND REFERENCES

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4. Pacific Northwest River Basins Commission, Meteorology Committee, Climatological Handbook Columbia Basin States, Precipitation, Vol. 2, September 1969.

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7. U.S. Department of the Army, Corps of Engineers, Hydrologic Engineering Center, HEC-2 Water-Surface Profiles, Generalized Computer Program, Davis, California, September 1982.

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10. U.S. Department of Housing and Urban Development, Federal Insurance Administration, Flood Hazard Boundary Map, City of Dayton, Scale 1:9,600, April 1976.

11. U.S. Department of Housing and Urban Development, Federal Insurance Administration, Flood Hazard Boundary Map, City of Starbuck, Scale 1:4,800, January 1975.

Chow, Ven Te, Open Channel Hydraulics, McGraw-Hill Book Company, 1959.

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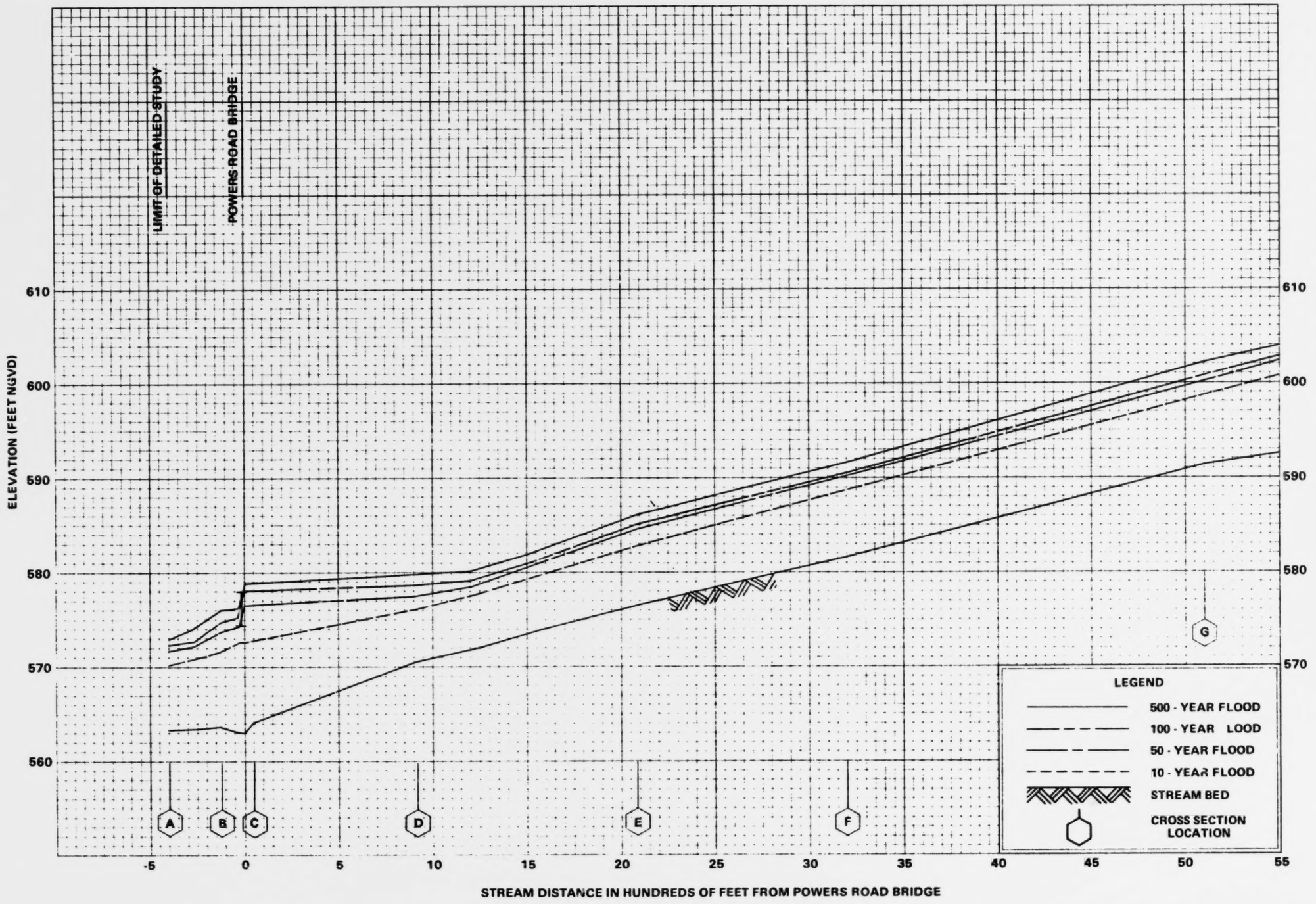


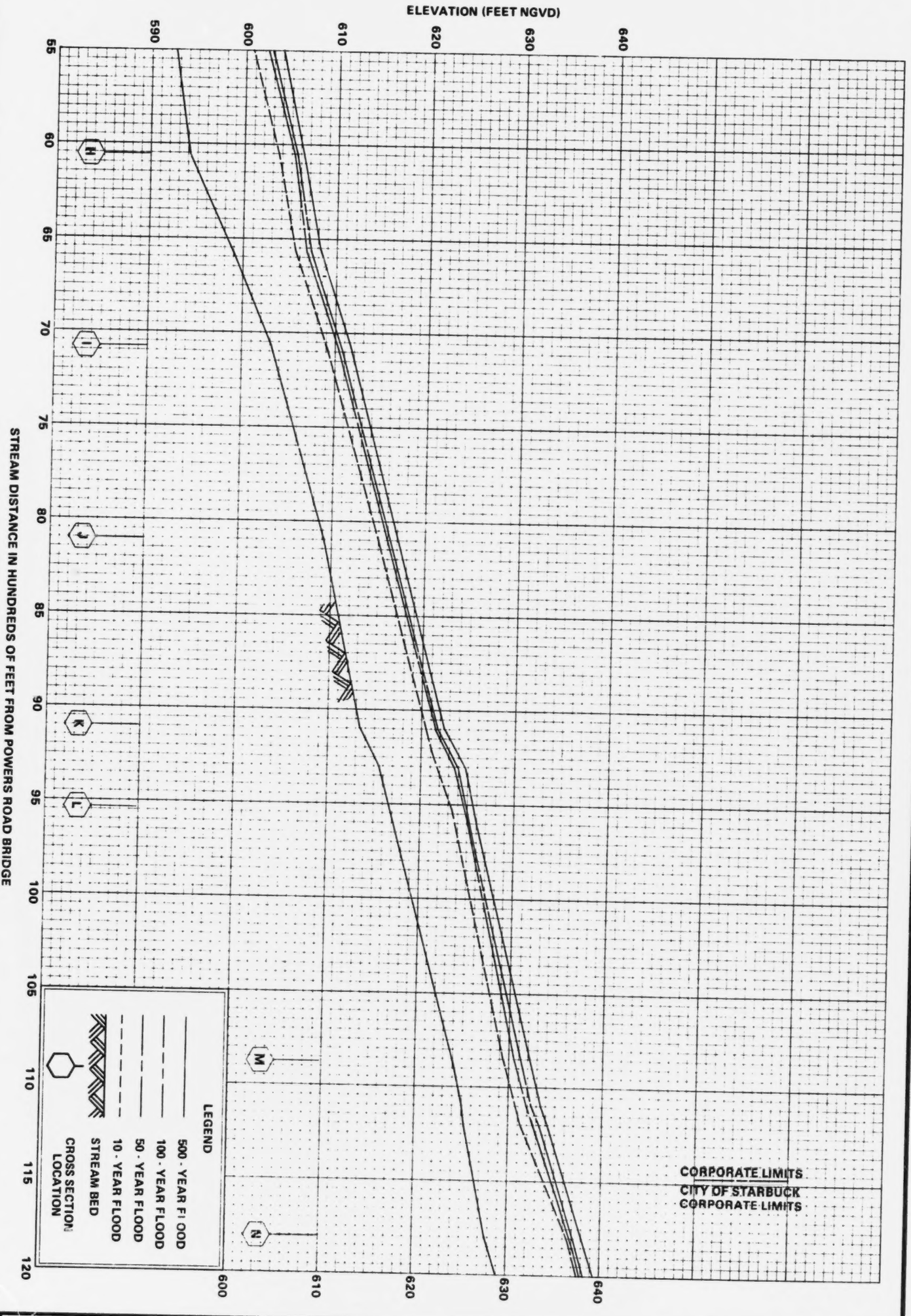
FLOOD PROFILES

TUCANNON RIVER

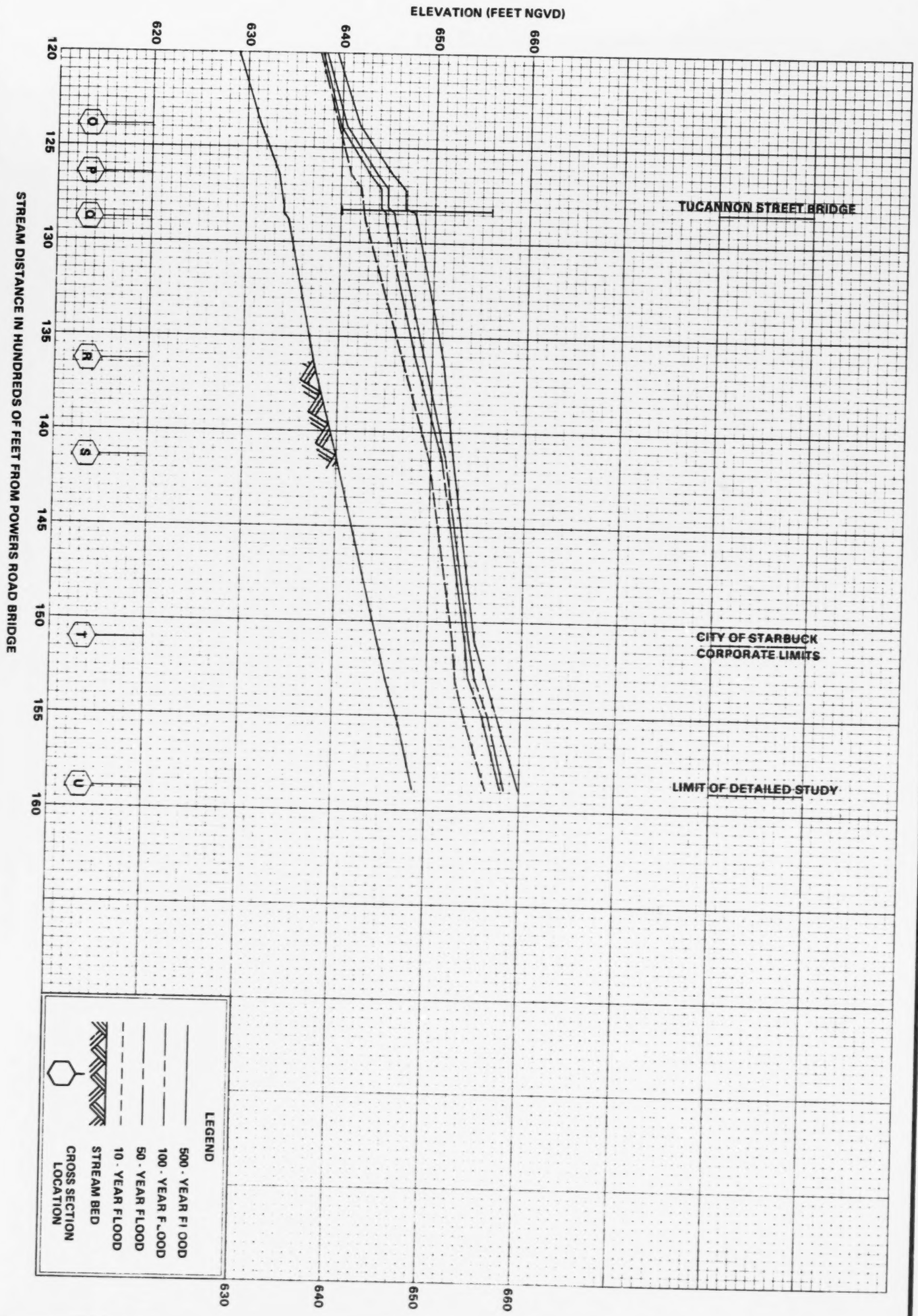
FEDERAL EMERGENCY MANAGEMENT AGENCY

COLUMBIA COUNTY, WA AND INCORPORATED AREAS

01P



02P	FEDERAL EMERGENCY MANAGEMENT AGENCY COLUMBIA COUNTY, WA AND INCORPORATED AREAS	FLOOD PROFILES TUCANNON RIVER



03P

FEDERAL EMERGENCY MANAGEMENT AGENCY

COLUMBIA COUNTY, WA
AND INCORPORATED AREAS

FLOOD PROFILES

TUCANNON RIVER

100-, AND 500 - YEAR FLOODS COINCIDE

LIMIT OF DETAILED STUDY

COUNTY ROAD 2427

ELEVATION (FEET NGVD)

1525
1520
1515
1510
1505
1500

A
B
C

-10 -8 -6 -4 -2 0 2 4 6 8 10 12 14

STREAM DISTANCE IN HUNDREDS OF FEET FROM COUNTY ROAD 2427 BRIDGE

LEGEND

- 500 - YEAR FLOOD
- 100 - YEAR FLOOD
- 50 - YEAR FLOOD
- 10 - YEAR FLOOD
- STREAM BED
- CROSS SECTION LOCATION

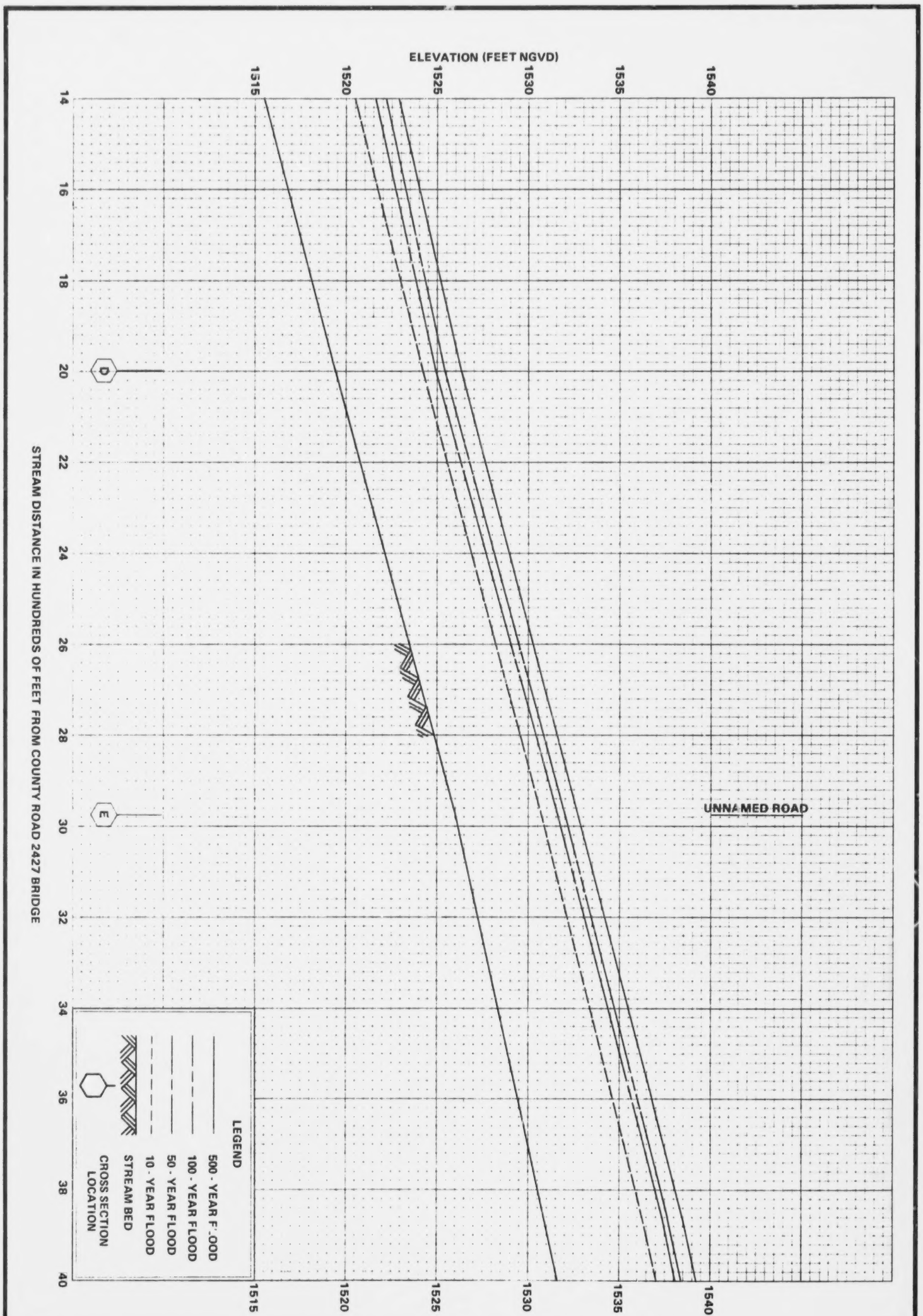
FLOOD PROFILES

TOUCHET RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

COLUMBIA COUNTY, WA
AND INCORPORATED AREAS

04P



FEDERAL EMERGENCY MANAGEMENT AGENCY

COLUMBIA COUNTY, WA
AND INCORPORATED AREAS

05P

FLOOD PROFILES

TOUCHET RIVER

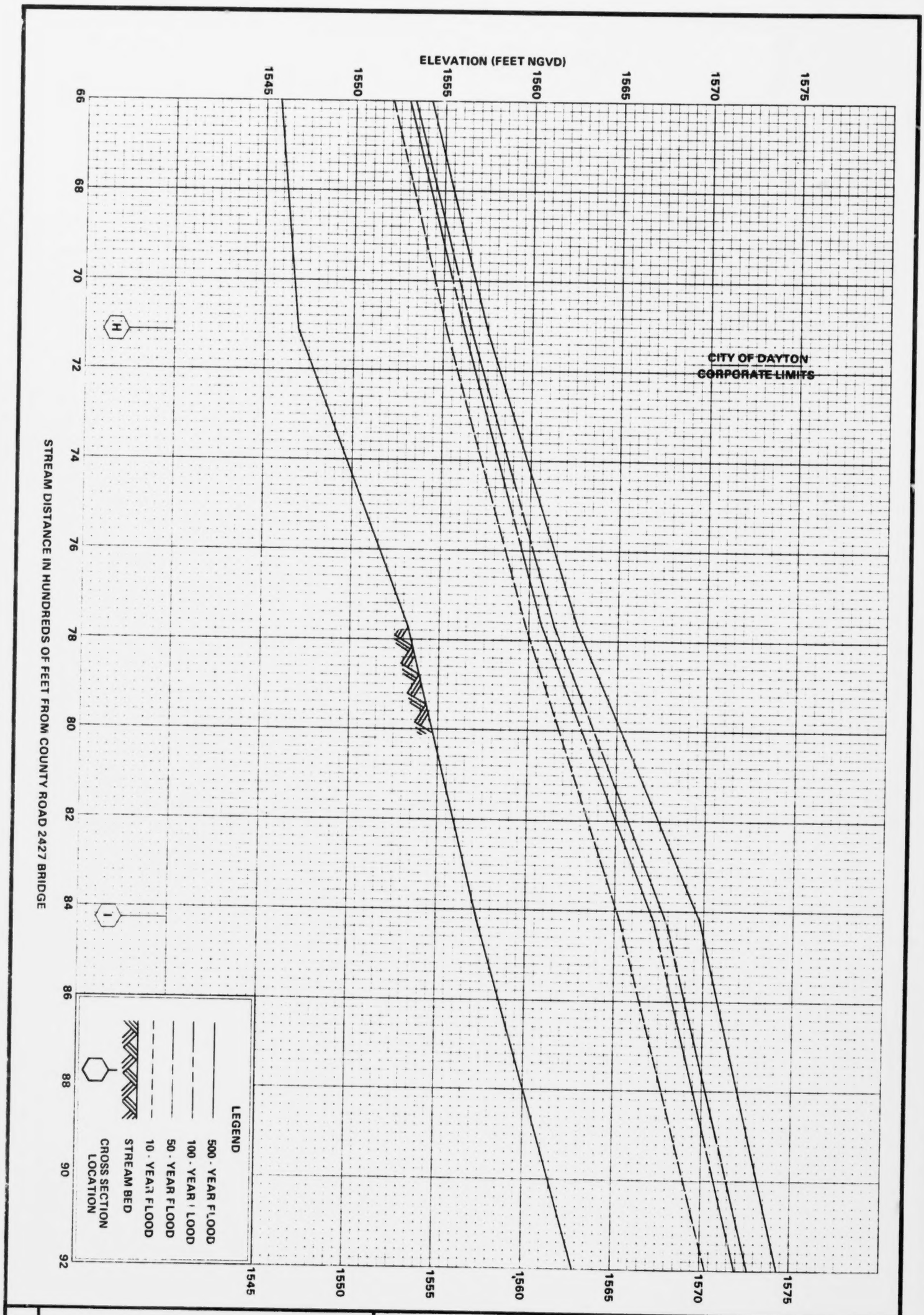
FLOOD PROFILES

TOUCHET RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

COLUMBIA COUNTY, WA
AND INCORPORATED AREAS

06P



07P	FEDERAL EMERGENCY MANAGEMENT AGENCY COLUMBIA COUNTY, WA AND INCORPORATED AREAS	FLOOD PROFILES TOUCHET RIVER

FLOOD PROFILES

TOUCHET RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

COLUMBIA COUNTY, WA
AND INCORPORATED AREAS

08P

FLOOD PROFILES

TOUCHET RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

COLUMBIA COUNTY, WA
AND INCORPORATED AREAS

09P

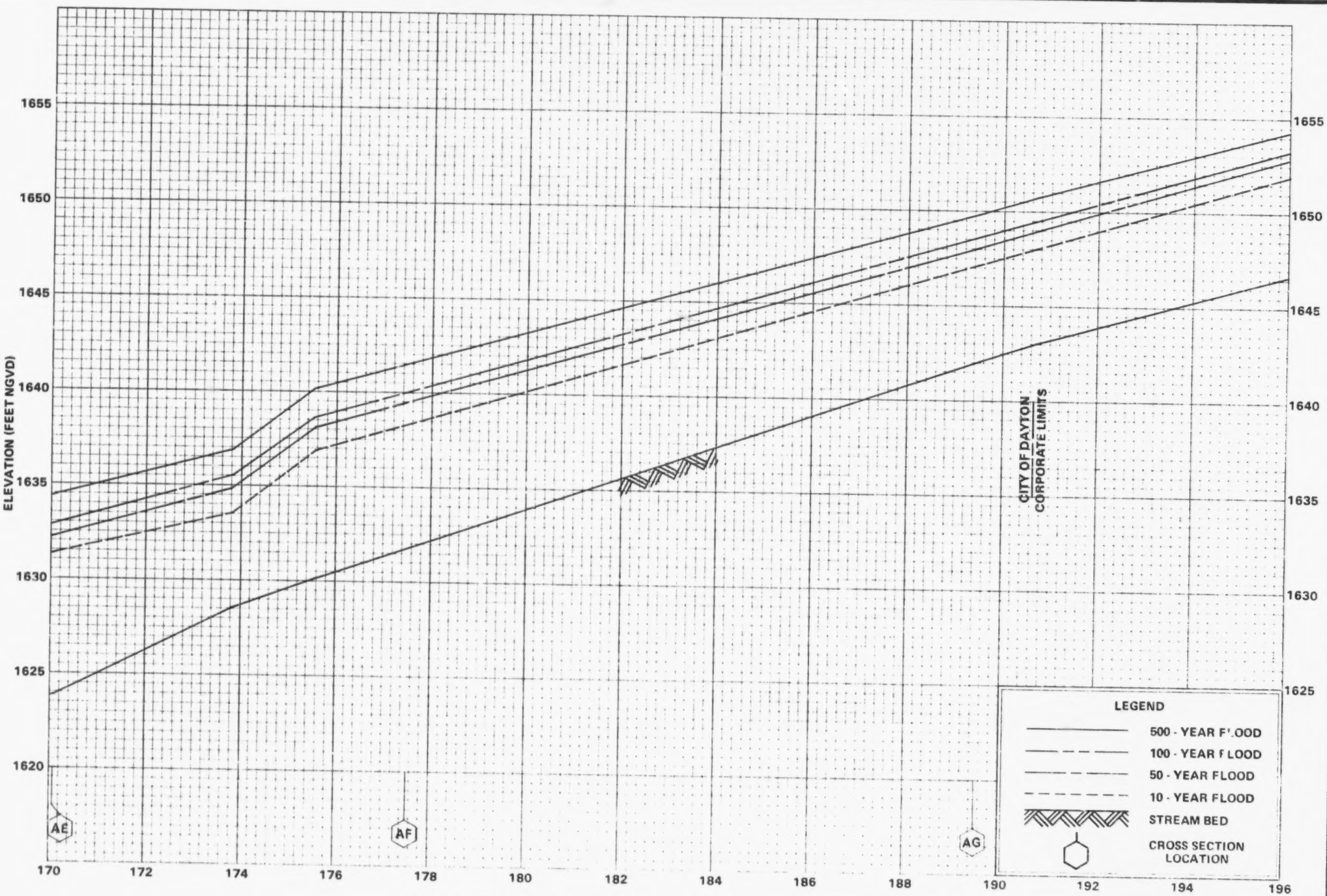
FLOOD PROFILES

TOUCHET RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

COLUMBIA COUNTY, WA
AND INCORPORATED AREAS

10P



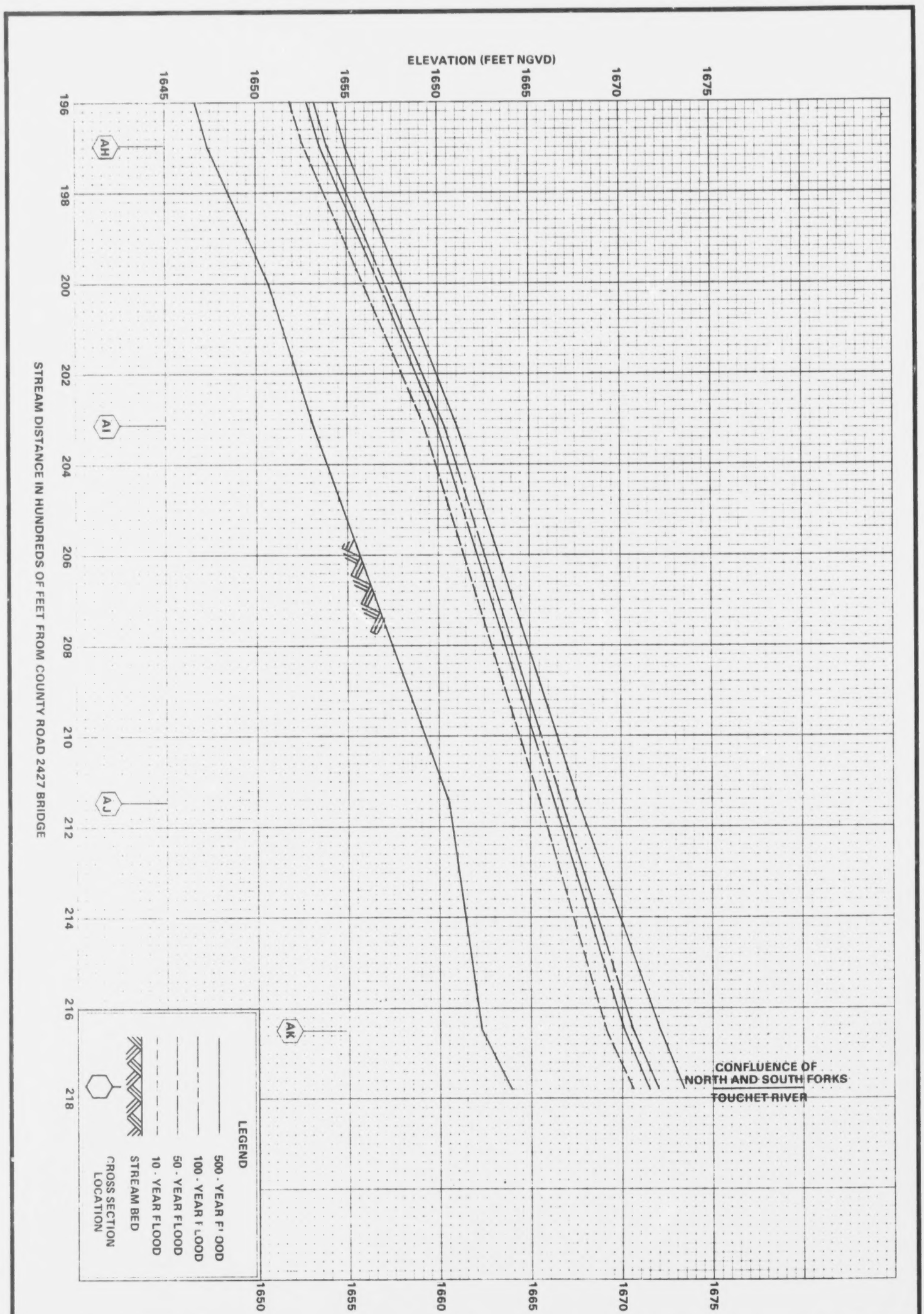
FLOOD PROFILES

TOUCHET RIVER

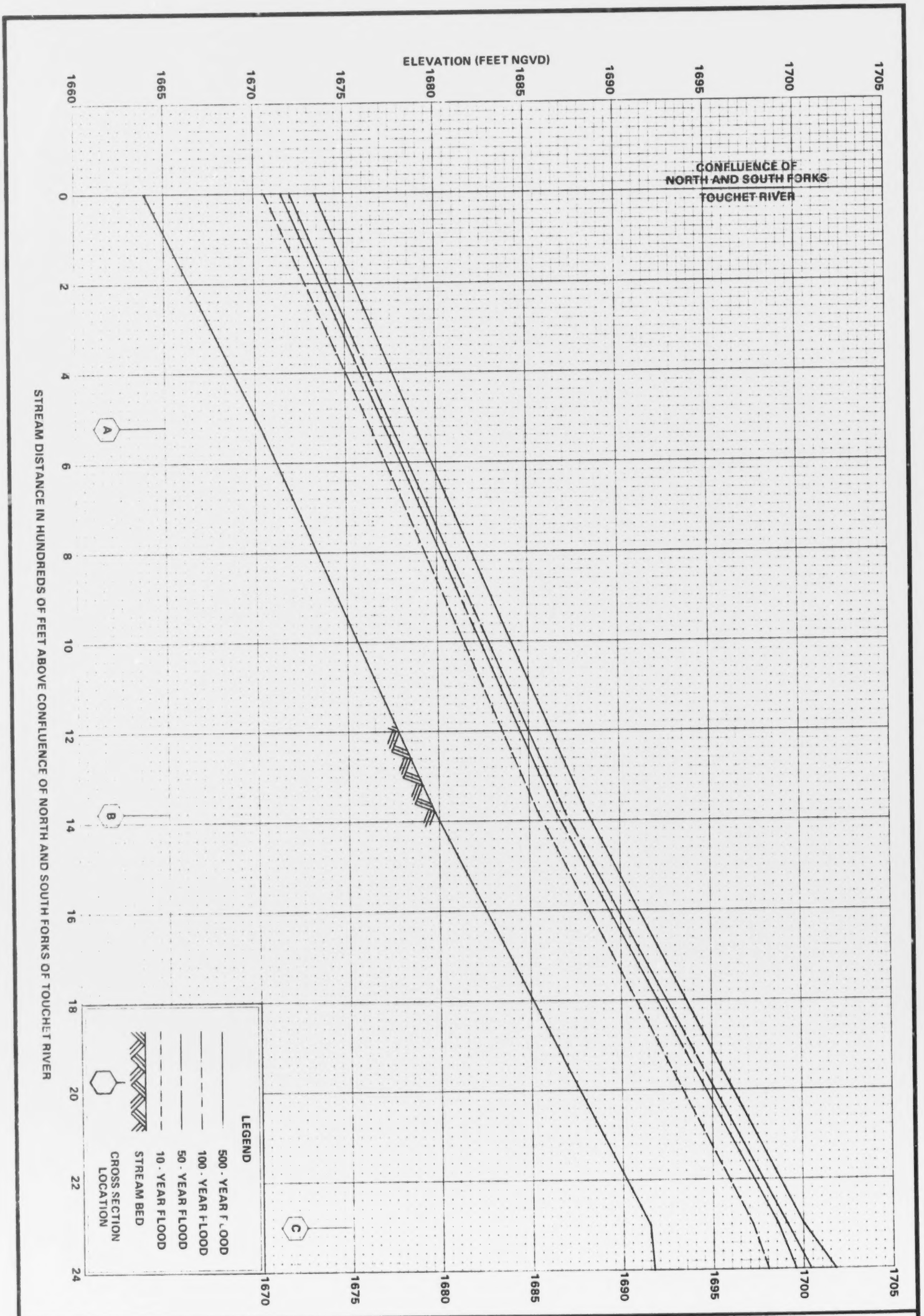
FEDERAL EMERGENCY MANAGEMENT AGENCY

COLUMBIA COUNTY, WA
AND INCORPORATED AREAS

11P



12P	FEDERAL EMERGENCY MANAGEMENT AGENCY COLUMBIA COUNTY, WA AND INCORPORATED AREAS	FLOOD PROFILES TOUCHET RIVER



FEDERAL EMERGENCY MANAGEMENT AGENCY

COLUMBIA COUNTY, WA
AND INCORPORATED AREAS

FLOOD PROFILES

NORTH FORK TOUCHET RIVER

13P

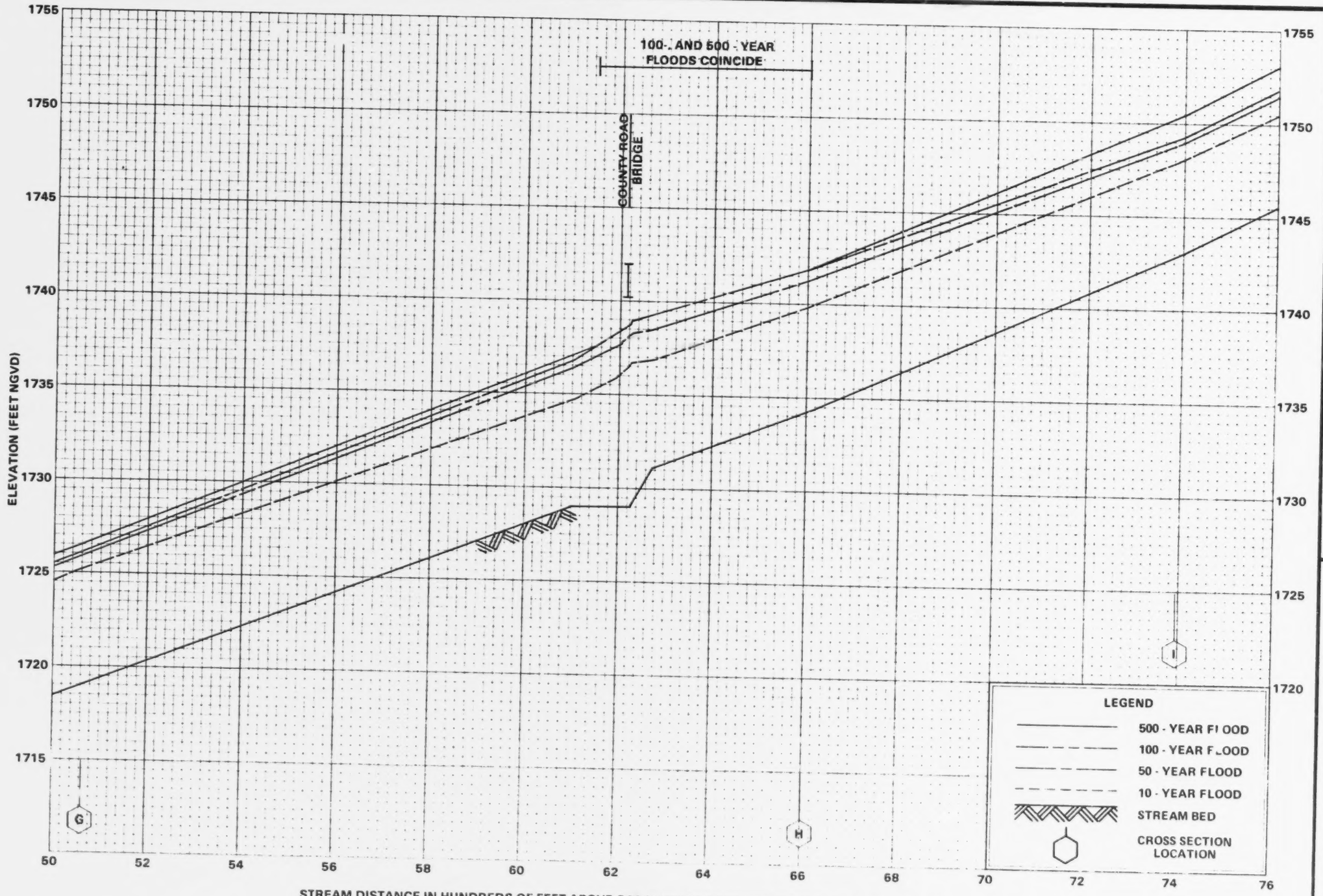
FLOOD PROFILES

NORTH FORK TOUCHET RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

COLUMBIA COUNTY, WA
AND INCORPORATED AREAS

14P



FLOOD PROFILES

NORTH FORK TOUCHET RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

COLUMBIA COUNTY, WA
AND INCORPORATED AREAS

15P

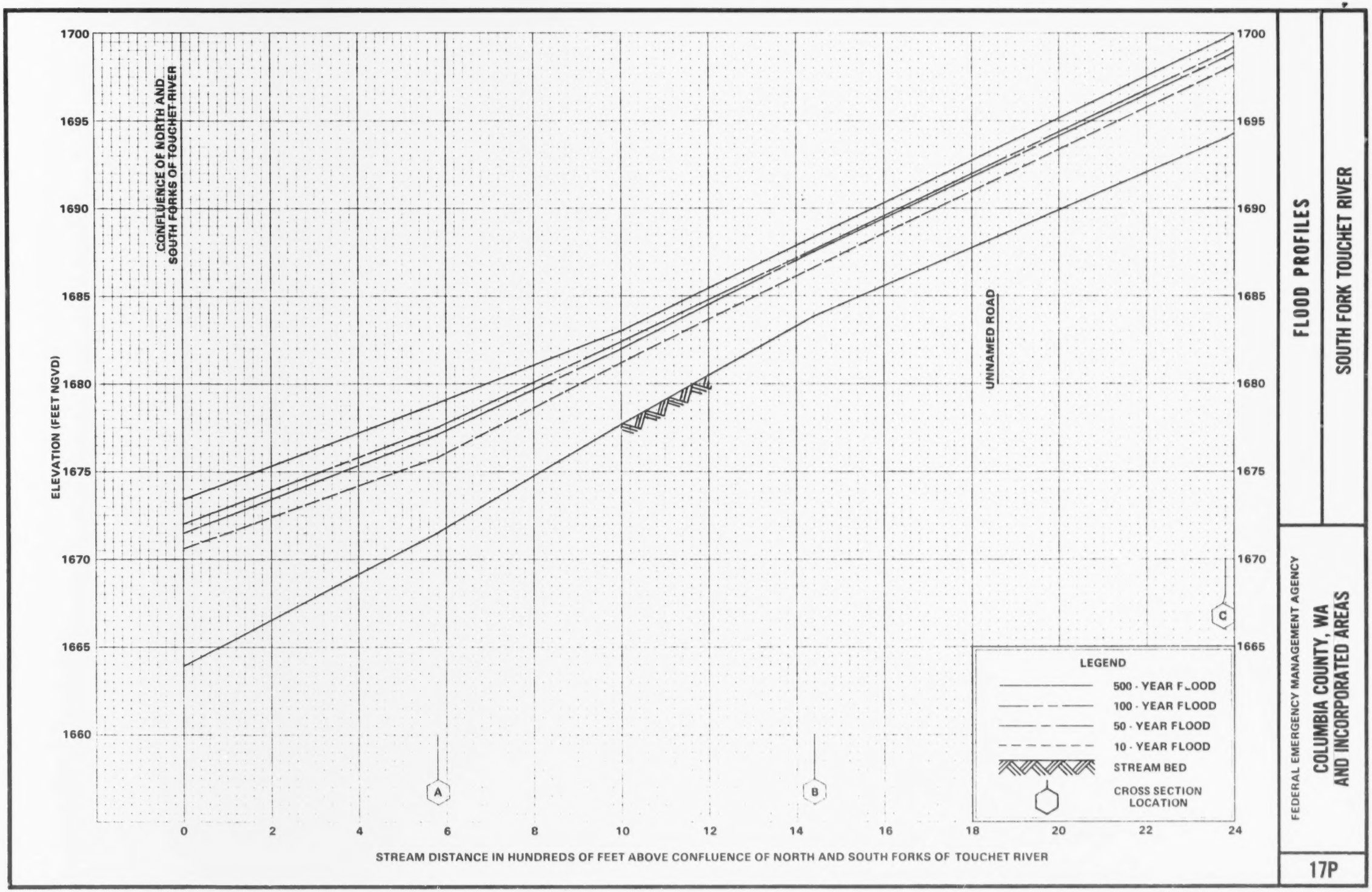
FLOOD PROFILES

NORTH FORK TOUCHET RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

COLUMBIA COUNTY, WA
AND INCORPORATED AREAS

16P



FLOOD PROFILES

SOUTH FORK TOUCHET RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

COLUMBIA COUNTY, WA
AND INCORPORATED AREAS

17P

FLOOD PROFILES

SOUTH FORK TOUCHET RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

COLUMBIA COUNTY, WA
AND INCORPORATED AREAS

18P

FLOOD PROFILES

SOUTH FORK TOUCHET RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

COLUMBIA COUNTY, WA
AND INCORPORATED AREAS

19P

STREAM DISTANCE IN HUNDREDS OF FEET ABOVE CONFLUENCE OF NORTH AND SOUTH FORKS OF TOUCHET RIVER

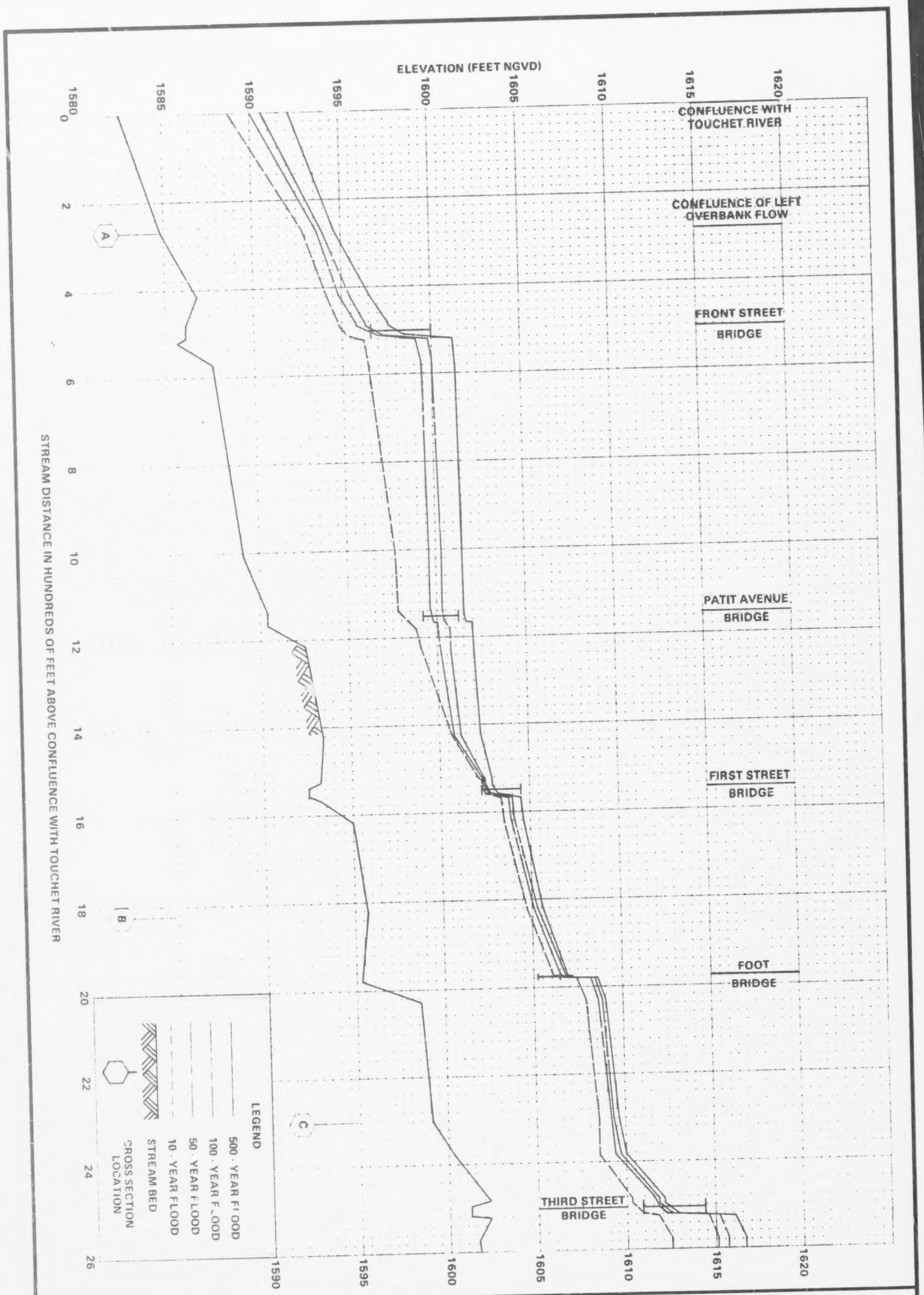
FLOOD PROFILES

SOUTH FORK TOUCHET RIVER

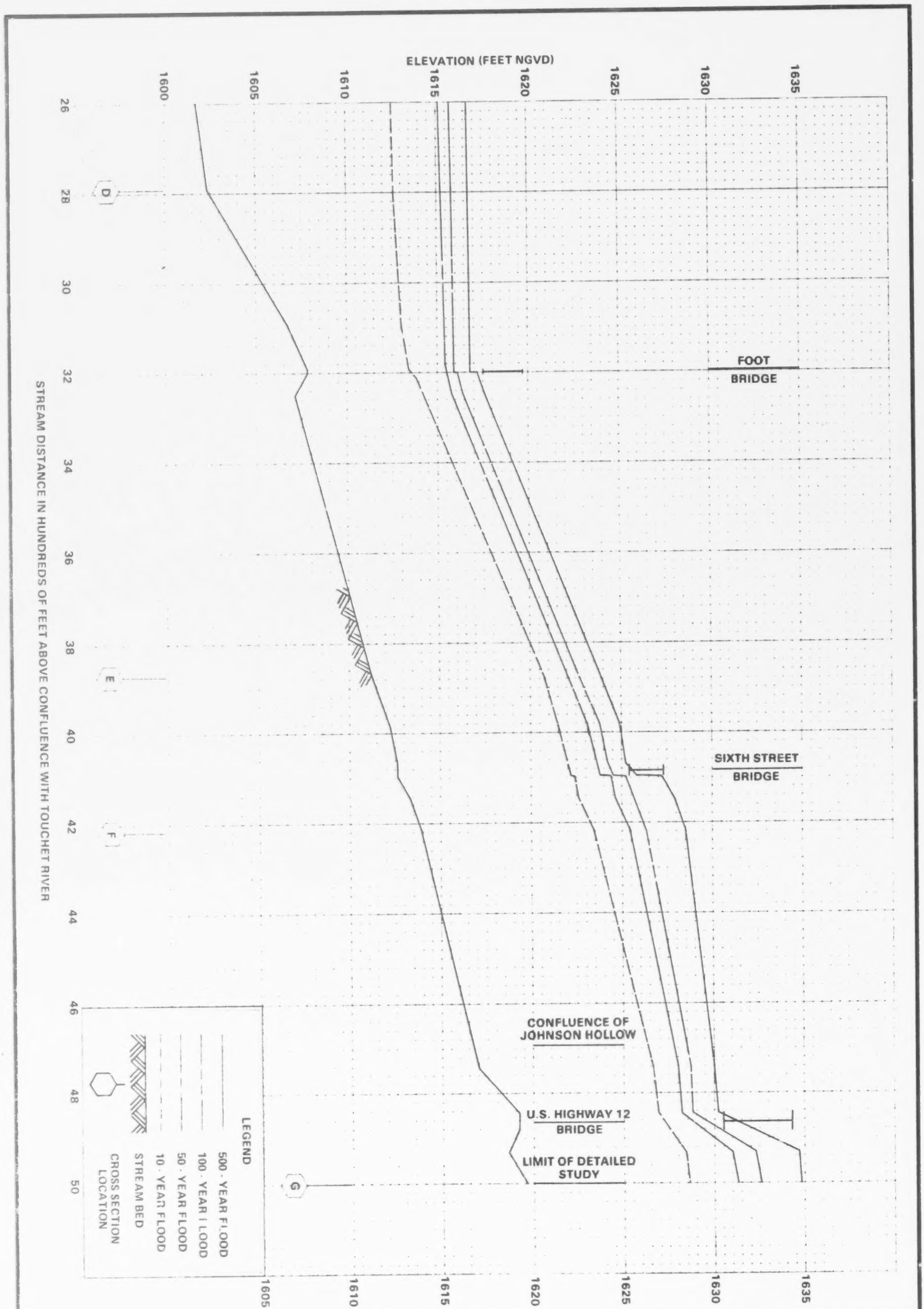
FEDERAL EMERGENCY MANAGEMENT AGENCY

COLUMBIA COUNTY, WA
AND INCORPORATED AREAS

20P



21P	FEDERAL EMERGENCY MANAGEMENT AGENCY COLUMBIA COUNTY, WA AND INCORPORATED AREAS	FLOOD PROFILES PATIT CREEK



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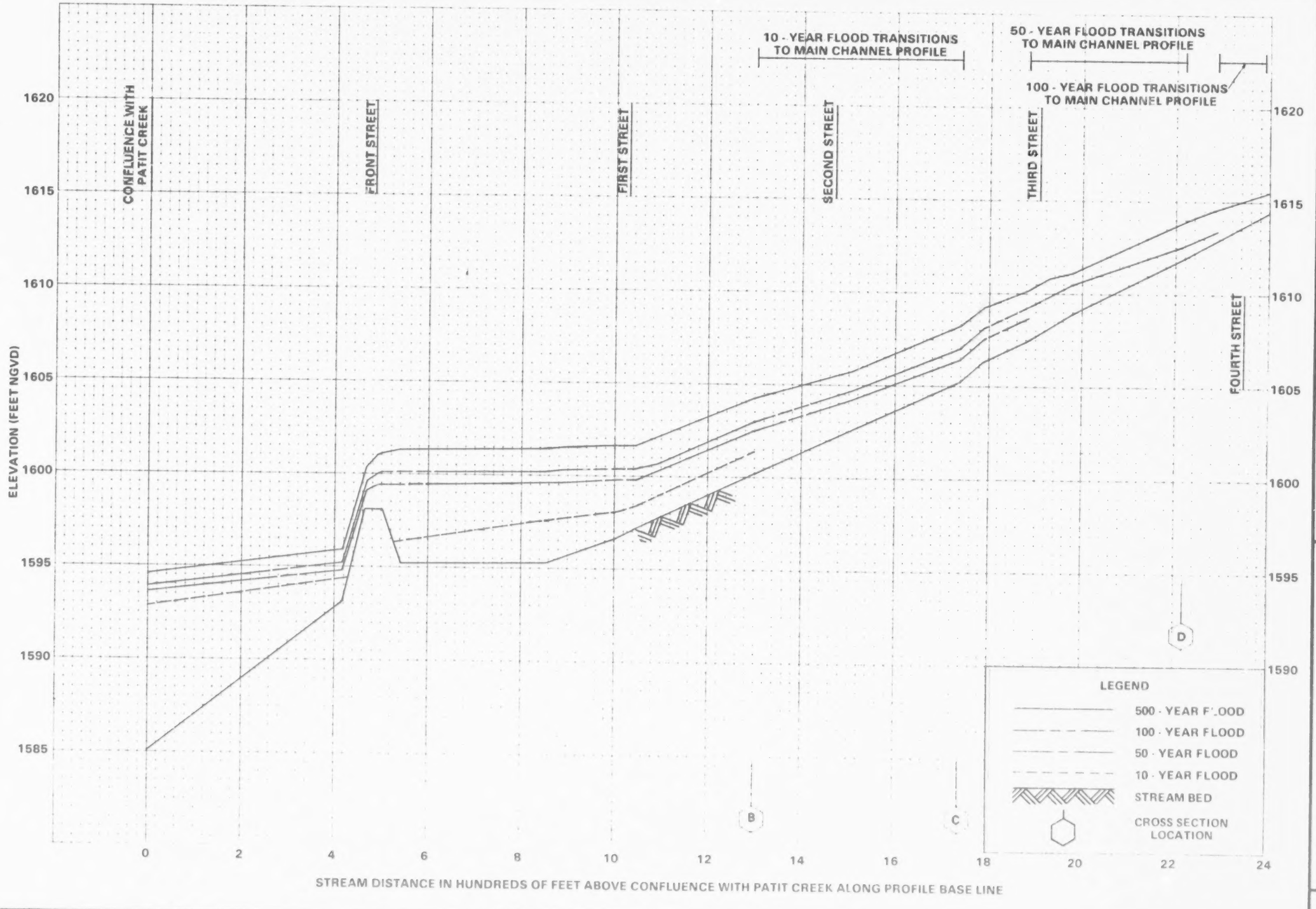
FEDERAL EMERGENCY MANAGEMENT AGENCY

COLUMBIA COUNTY, WA
AND INCORPORATED AREAS

FLOOD PROFILES

PATIT CREEK



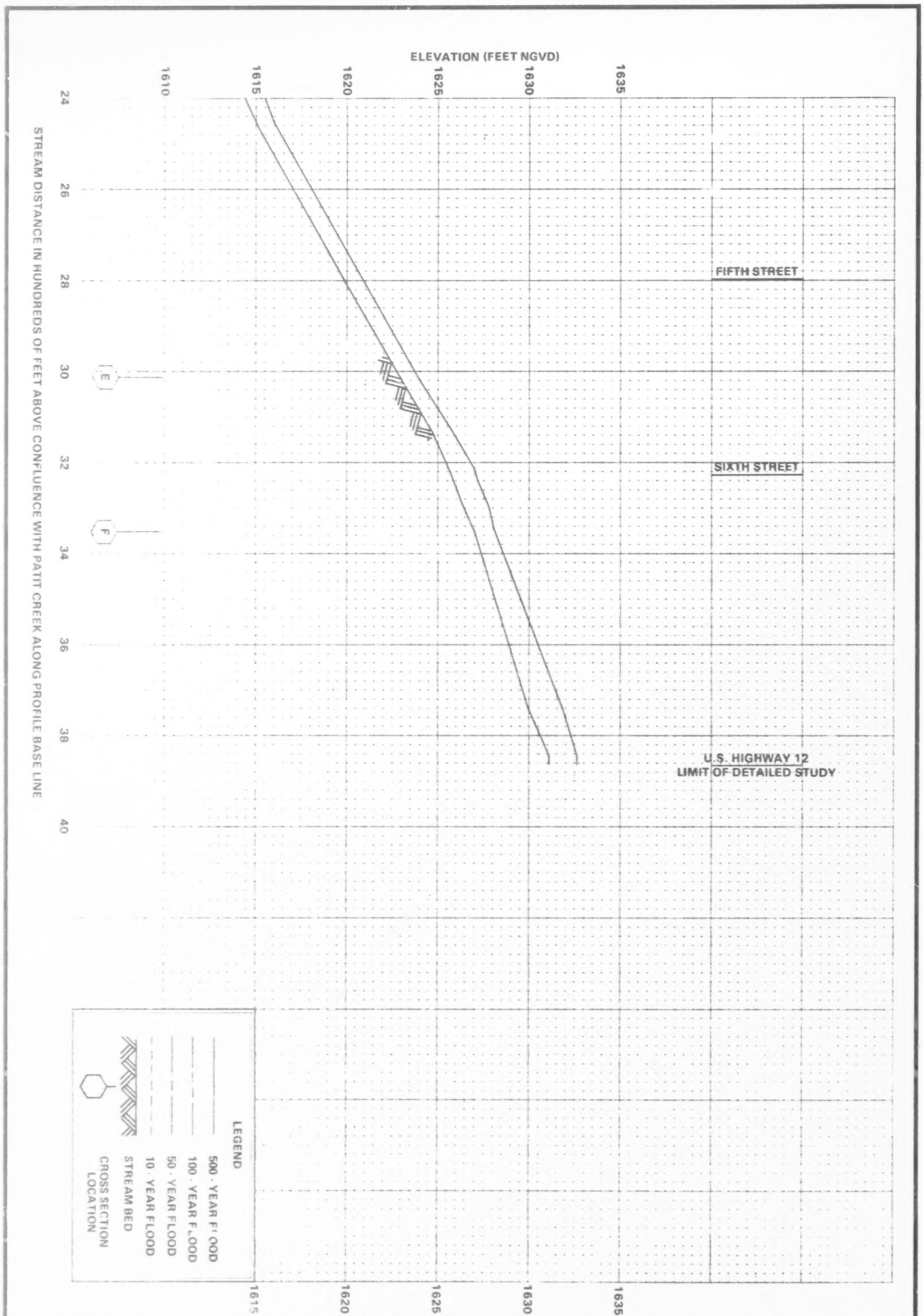
FLOOD PROFILES

PATIT CREEK (LEFT OVERBANK)

FEDERAL EMERGENCY MANAGEMENT AGENCY

COLUMBIA COUNTY, WA
AND INCORPORATED AREAS

23P



24P

FEDERAL EMERGENCY MANAGEMENT AGENCY

COLUMBIA COUNTY, WA
AND INCORPORATED AREAS

FLOOD PROFILES

PATIT CREEK (LEFT OVERBANK)

BACKWATER FROM PATIT CREEK

50-, 100-, AND 500 - YEAR FLOODS COINCIDE

100-, AND 500 - YEAR FLOODS COINCIDE

CONFLUENCE WITH PATIT CREEK

UNNAMED ROAD

DAYTON AVENUE BRIDGE

CITY OF DAYTON CORPORATE LIMITS

ELEVATION (FEET NGVD)

1645
1640
1635
1630
1625
1620
1615

A
B
C

0 1 2 3 4 5 6 7 8 9 10 11 12

STREAM DISTANCE IN HUNDREDS OF FEET ABOVE CONFLUENCE WITH PATIT CREEK

LEGEND

- 500 - YEAR FLOOD
- 100 - YEAR FLOOD
- 50 - YEAR FLOOD
- 10 - YEAR FLOOD
- STREAM BED
- CROSS SECTION LOCATION

FLOOD PROFILES

JOHNSON HOLLOW

FEDERAL EMERGENCY MANAGEMENT AGENCY

COLUMBIA COUNTY, WA
AND INCORPORATED AREAS

25P

FLOOD PROFILES

JOHNSON HOLLOW

FEDERAL EMERGENCY MANAGEMENT AGENCY

COLUMBIA COUNTY, WA
AND INCORPORATED AREAS

26P

UNNAMED ROAD

ELEVATION (FEET NGVD)

1690
1685
1680
1675
1670
1665
1660
1655

25 26 27 28 29 30 31 32 33 34 35 36 37 38

STREAM DISTANCE IN HUNDREDS OF FEET ABOVE CONFLUENCE WITH PATIT CREEK

F

LEGEND

- 500 - YEAR FLOOD
- 100 - YEAR FLOOD
- 50 - YEAR FLOOD
- 10 - YEAR FLOOD
- STREAM BED
- CROSS SECTION LOCATION

FLOOD PROFILES

JOHNSON HOLLOW

FEDERAL EMERGENCY MANAGEMENT AGENCY

COLUMBIA COUNTY, WA
AND INCORPORATED AREAS

27P

1705
1700
1695
1690
1685
1680

ELEVATION (FEET NGVD)

G

38 39 40 41 42 43 44 45 46 47 48 49 50 51

STREAM DISTANCE IN HUNDREDS OF FEET ABOVE CONFLUENCE WITH PATIT CREEK

LEGEND

500 - YEAR FLOOD
100 - YEAR FLOOD
50 - YEAR FLOOD
10 - YEAR FLOOD
STREAM BED
CROSS SECTION LOCATION

FLOOD PROFILES

JOHNSON HOLLOW

FEDERAL EMERGENCY MANAGEMENT AGENCY

COLUMBIA COUNTY, WA
AND INCORPORATED AREAS

28P

FLOOD PROFILES

JOHNSON HOLLOW

FEDERAL EMERGENCY MANAGEMENT AGENCY

COLUMBIA COUNTY, WA
AND INCORPORATED AREAS

29P

EXHIBIT 3 - ELEVATION REFERENCE MARKS
COLUMBIA COUNTY, WASHINGTON AND INCORPORATED AREAS

Reference Mark	Elevation (feet NGVD)	Description of Location
RM 1	577.83	A 5/8 inch rebar with aluminum cap stamped "CCS-84-11" set approximately 30 feet northeast of the Powers Road railroad crossing.
RM 2	618.37	A screw and washer stamped "CCS-84-8" set in center of State Highway 261 and approximately 3,000 feet southeast of Powers Road intersection.
RM 3	626.79	A screw and washer stamped "CCS-84-6" set in center of State Highway 261 approximately 300 feet northwest of the Little Goose Dam Road intersection.
RM 4	645.69	At Starbuck, Columbia County, 245 feet south of the south corner of the Union Pacific Railroad station, 31.5 feet west of the centerline of Front Street, in the east wall of the Farmers Building, 0.7 foot south of the northeast corner, and 4.5 feet above the sidewalk. A standard disk stamped "Starbuck 1936" and set vertically.
RM 5	1568.75	[illegible] miles southwest along U.S. Highway 12 from the courthouse at Dayton, 0.15 mile northeast of milepost 366, at the junction of county road 46 north, 49 feet northwest of the centerline of the highway, 90 feet east of the centerline of the road, 6+1/2 feet northeast of telephone pole R10 with a guy wire, 3 feet northeast of a fence corner, 0.8 foot southeast of a fence, 1.0 foot south of a witness post, about 1 feet lower than the highway, and set in the top of a concrete post projecting 0.1 foot above the ground. U.S.C. and GS disk stamped "[illegible] 1964."
RM 6	1600.98	At Dayton 0.3 mile southwest along U.S. Highway 12 from the courthouse, in R. 39., T. 10 N., sec. 30, in the top and 0.7 foot northeast of the southwest end of the northwest concrete sidewalk of a concrete bridge over Touchet River, 25 feet northwest of the centerline of the highway, 22 feet southeast of the southwest end of a guardrail and about 1 foot higher than the highway. U.S.C. and GS disk stamped "N39 Reset 1965."

EXHIBIT 3 - ELEVATION REFERENCE MARKS (cont'd)
COLUMBIA COUNTY, WASHINGTON AND INCORPORATED AREAS

Reference Mark	Elevation (feet NGVD)	Description of Location
RM 7	1674.55	A screw and washer stamped "CCD-84-22" set in the center of the Touchet River Road approximately 200 feet southeast of the Dayton city limits.
RM 8	1703.56	A screw and washer set in the intersection of the North Fork Touchet River Road and South Touchet Road stamped "CCD-84-23."
RM 9	1784.32	A screw and washer set in the center of the North Fork Touchet River Road approximately 1,200 feet northwest of the Crall Hollow Road. Stamped "CCD -84-26."
RM 10	1733.39	A screw and washer set in the center of South Touchet Road approximately 2,200 feet south of the North Fork Touchet River bridge stamped "CCD-84-31."
RM 11	1769.55	A screw and washer set in the center of South Touchet Road approximately 1,100 feet north of the Harting Grade Road intersection stamped "CCD-84-33."
RM 12	1612.64	At Dayton at the west corner of the intersection of U.S. Highway 12 (Main Street) and Third Street in R. 39 E., T. 10 N., sec. 30 at the east corner of the Columbia County Courthouse yard in the top and 7.1 feet southwest of the northeast end of the concrete retaining wall along the southeast side of the grounds, 14.1 feet northwest of the northwest curb of the highway, 11.3 feet southwest of the southwest curb of Third Street and about 1-1/2 feet higher than the street. PPM disk stamped "1612 1926."
RM 13	1664.16	0.4 mile north along U.S. Highway 12 from the courthouse at Dayton, in R. 39 E., T. 10N., sec. 30, in the top and 0.7 foot north of the south end of the west concrete guardrail of a highway overpass over the Northern Pacific Railroad, 16 feet west of the centerline of the highway, 0.5 foot south of the south side of the concrete base of a steel light pole, and about 3 feet higher than the highway, U.S.C. and GS disk stamped "M39 1933."

EXHIBIT 3 - ELEVATION REFERENCE MARKS (cont'd)
COLUMBIA COUNTY, WASHINGTON AND INCORPORATED AREAS

Reference Mark	Elevation (feet NGVD)	Description of Location
RM 14	1670.65	0.8 mile north along U.S. Highway 12 from the courthouse at Dayton, in R. 39 E., T. 10 N., sec. 19, 0.2 mile north of milepost 368, 0.05 mile north of "DAYTON POPULATION" sign, 41-1/2 feet east of the centerline of the highway, 42-1/2 feet south of power pole 1039-196501 with a guy wire, 5.8 feet west of a fence, 0.7 foot north of a witness post, about 4 feet higher than the highway, and set in the top of a concrete post projecting 0.2 foot above the ground. U.S.C. and GS disk stamped "L39 1933."